

Zinc coated steel sheets (Bj LS)



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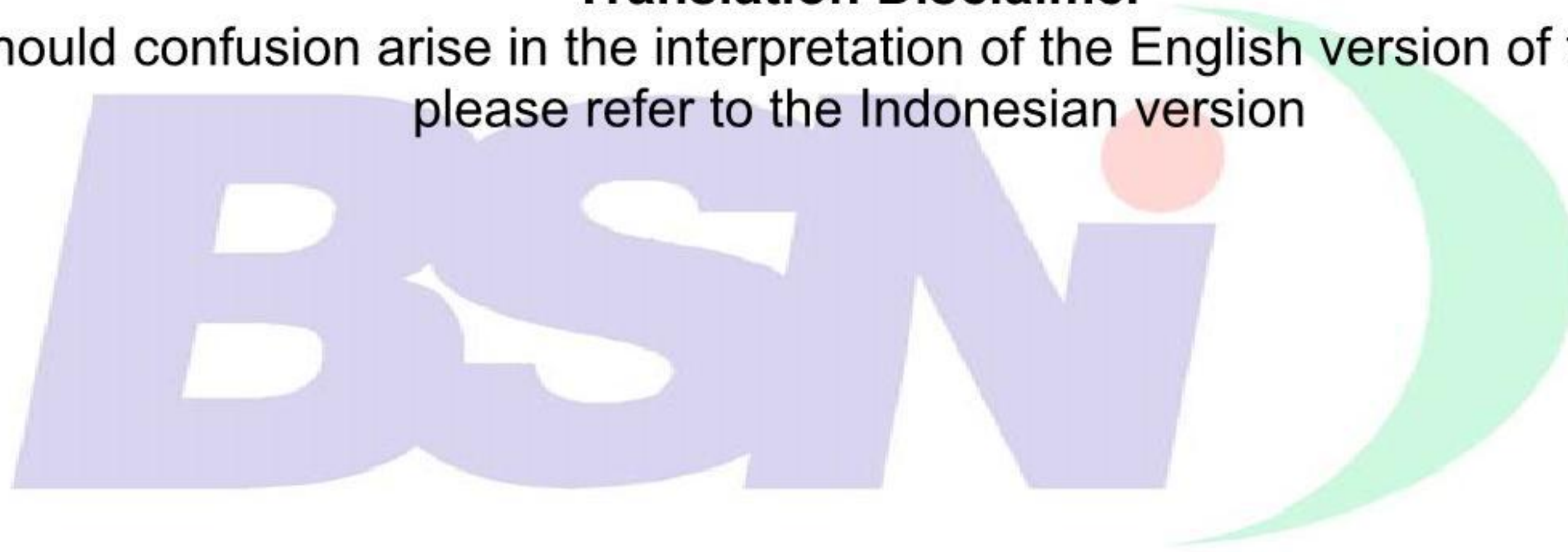
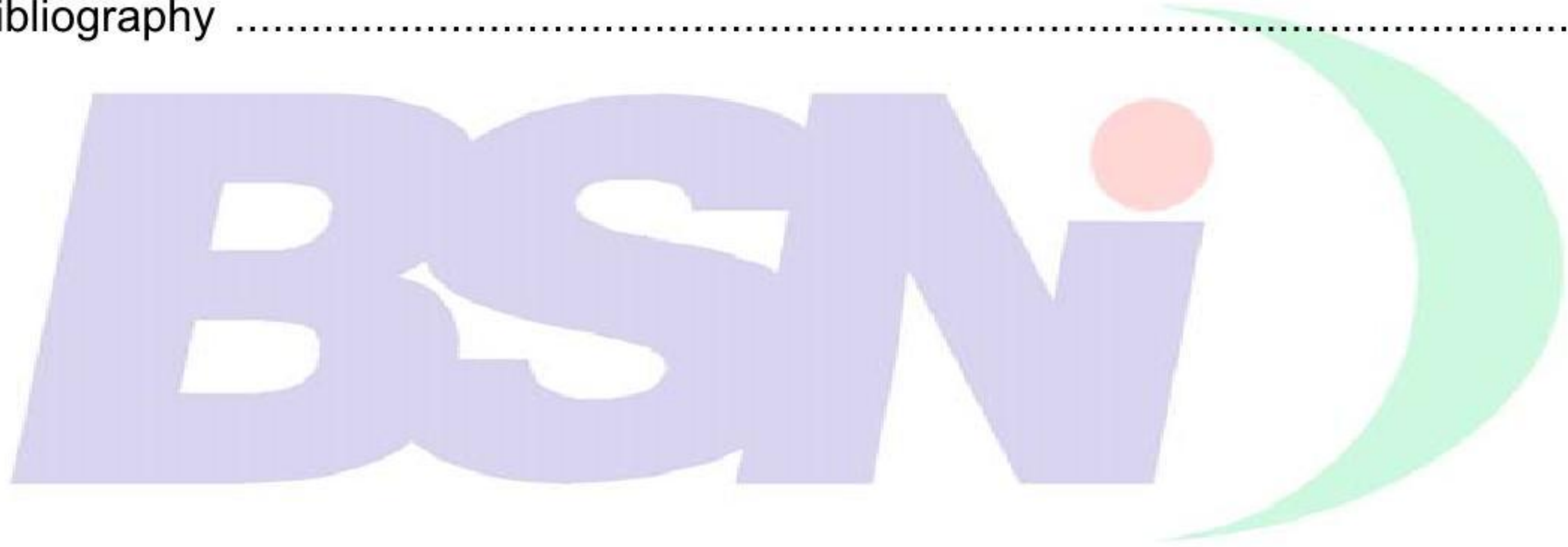




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Introduction

Standar Nasional Indonesia (SNI) *Zinc coated steel sheets (Bj.LS)* is a revision of SNI 07-2053-1995 and formulated based on the following considerations:

1. SNI 07-2053-1995 was adopted over 5 years ago, and need to be reviewed to accommodate to the needs of the consumers, manufacturing capabilities of the industry and the technology development
2. There is an urgent need to protect the end consumer against nonstandard imported goods through mandatory SNI implementation.

Deliberation of this standard was held in committee meetings, attended by representatives from various stakeholders such as universities, government, testing institutions, consumers and manufacturers.

The meetings were held in several stages, technical meetings, pre consensus meetings and the final consensus meeting held in Jakarta on September 16th, 2003.

This standard was drafted by the Technical Committee 5S, Iron, Steel and Steel Products.



Zinc coated steel sheets

(Bj LS)

1 Scope

This standard covers, normative references, terms and definitions, symbols and classifications, quality requirements, sampling, test methods, acceptance requirements and marking of zinc coated steel sheets on hot or cold rolled steel sheets, in the form of rolled, flat sheets and corrugated sheets, coated by means of hot immersion

2 Normative references

SNI 05-0719-1989, *Cara uji keras mikro Vickers beban 0,0096 sampai dengan 49 N.*
 SNI 07-0311-1989, *Cara uji lapis seng.*
 SNI 07-0371-1998, *Batang uji tarik untuk bahan logam.*
 SNI 07-0408-1989, *Cara uji tarik logam.*
 SNI 07-0410-1989, *Cara uji lengkung tekan logam.*
 SNI 07-0601-2006, *Baja lembaran, pelat dan gulungan canai panas (Bj P).*
 SNI 07-3567-2006, *Baja lembaran dan gulungan canai dingin (Bj D)*
 SNI 19-0406-1989, *Cara uji keras Rockwell B.*
 SNI 19-0721-1989, *Cara uji keras Rockwell T.*

3 Terms and definitions

3.1

flat/coiled zinc coated steel sheets (Bj LS)

flat/coiled steel sheet made from hot or cold rolled steel of which both surfaces are coated with zinc (Zn) by immersion in molten zinc of not less than 97 % weight percent zinc (including a normal 0,30 % weight percent or less of aluminum (Al))

3.2

zinc coated steel sheets (Bj LS)

zinc coated flat or corrugated steel sheets manufactured by hot or cold rolling process

3.3

coiled zinc coated steel

Bj LS in the form of coils manufactured by hot or cold rolling process

3.4

thickness marking on zinc coated steel

nominal thickness of base metal

3.5

zinc coating mass on both surfaces

mass difference between zinc coated steel and mass of base steel in g/m²

3.6

nominal width of Bj LS

width measured at the edge of steel coil or steel sheet in transverse direction

3.7

nominal length of Bj LS

length measured at the end of the steel sheet in rolling direction

3.8

width and length tolerances

permitted tolerance of nominal width and length of base metal

3.9

base metal of zinc coated sheets/coils

base metal steel sheets/coils manufactured by hot or cold rolling process

3.10

base metal nominal thickness of zinc coated steel sheets/coils

thickness at the center in transverse direction to rolling direction of the hot or cold rolled steel sheets/coils

3.11

thickness tolerance of base metal

thickness tolerance of base metal nominal thickness

3.12

nominal width of zinc coated base metal steel sheets/coils

width measured from the edge of steel sheets/coils perpendicular to rolling direction

3.13

nominal length of base metal zinc coated Bj LS

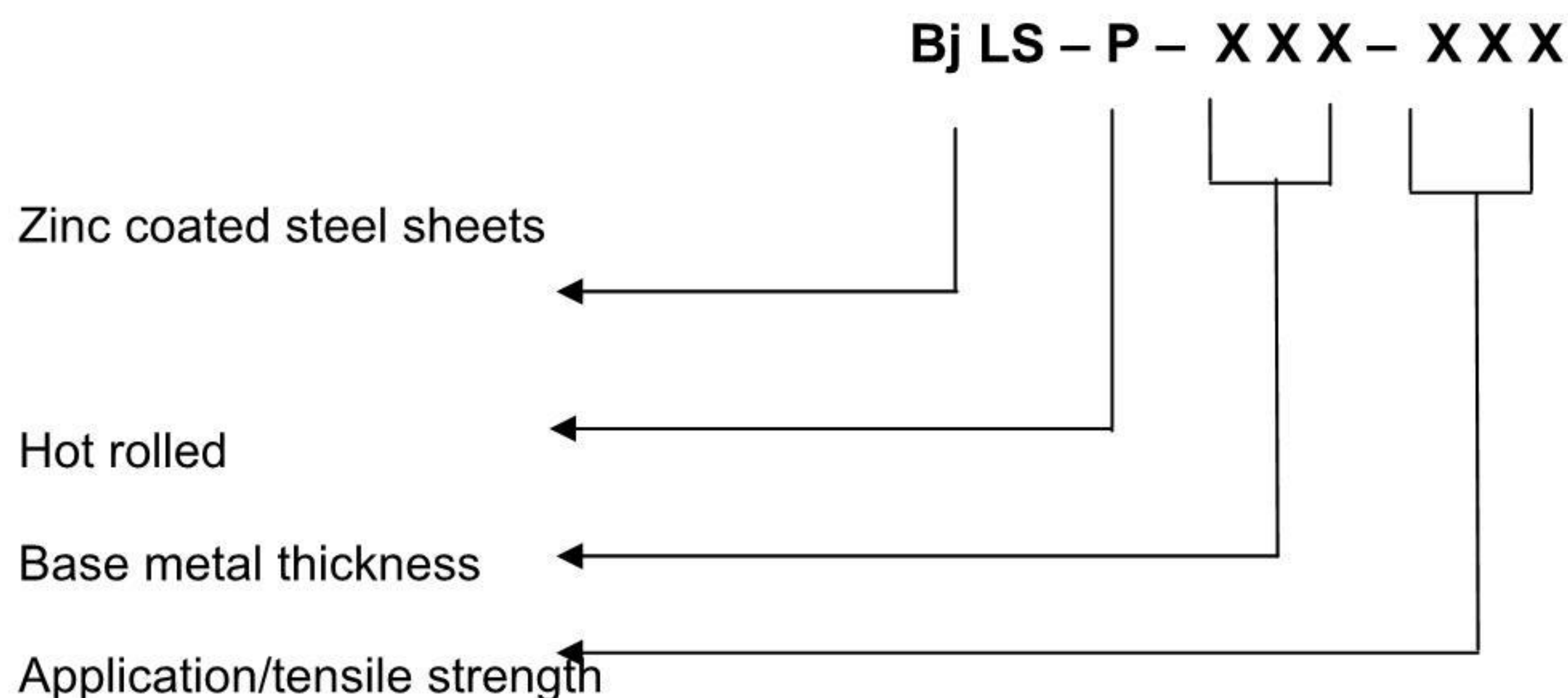
length measured in the rolling direction from edge to edge of the steel sheet

4 Symbols and classifications

4.1 Bj LS symbols

4.1.1 Bj LS symbols with hot rolled base metal

Symbols used to identify hot rolled Bj LS coils/sheets are shown as follows

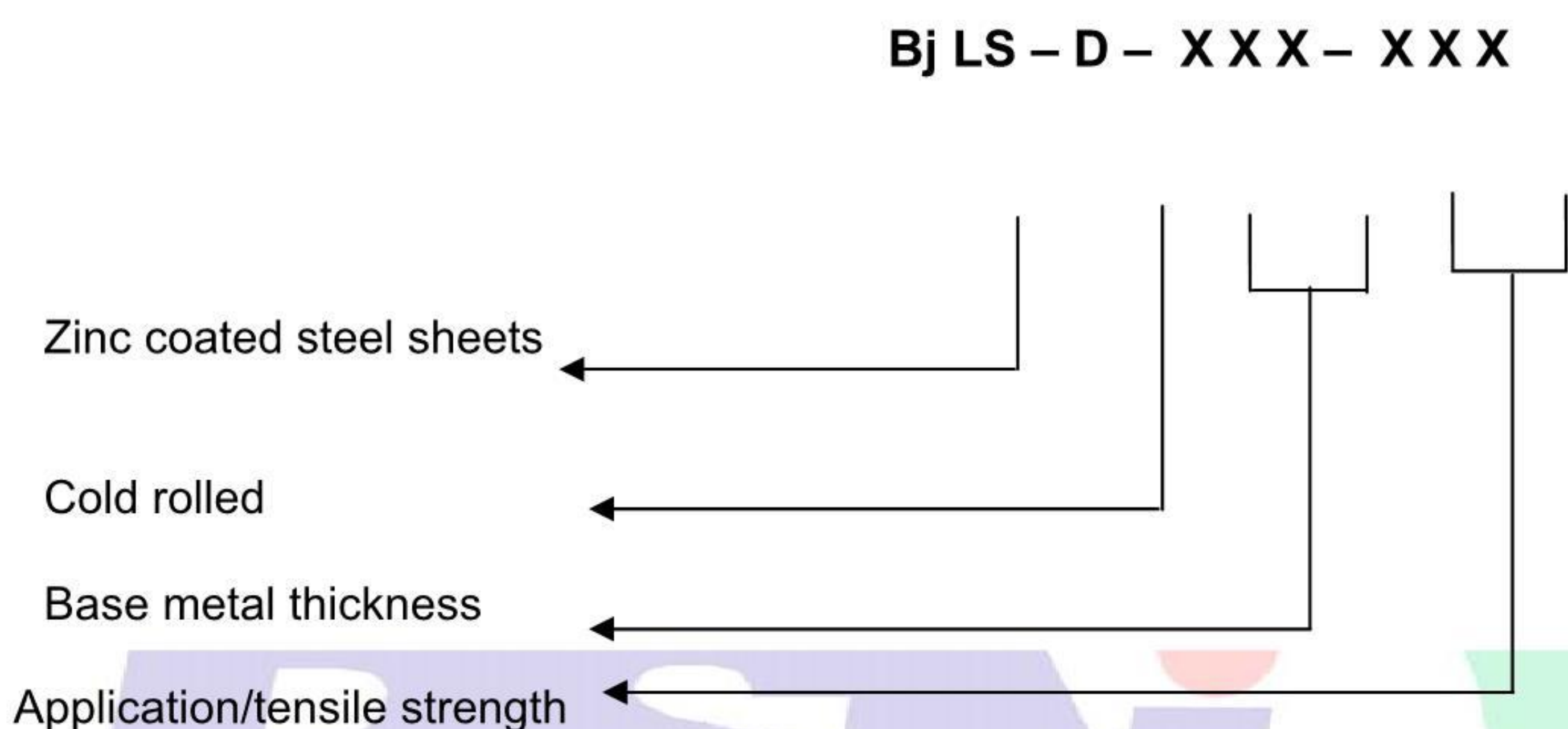


Example:

Bj LS-P -315-340 means Bj LS manufactured from hot rolled base metal, with nominal thickness of 3,15 mm and minimum tensile strength of 340 N/mm², for construction application.

Bj LS-P-315-C means Bj LS manufactured from hot rolled base metal, with nominal thickness of 3,15 mm for commercial application.

4.1.2 Bj LS symbols with cold rolled base metal



Example:

- Bj LS-D-120-340 means Bj LS manufactured from cold rolled base metal, thickness 1,20 mm and minimum tensile strength 340 N/mm², for construction application.
- Bj LS-D-020-K means Bj LS manufactured from cold rolled base metal, thickness 0,20 mm and for hard commercial application.
- Bj LS-D-020-L means Bj LS manufactured from cold rolled base metal, thickness 0,20 mm and for soft commercial application.
- Bj LS-D-080-570 means Bj LS manufactured from cold rolled base metal, thickness 0,80 mm and minimum tensile strength 570 N/mm²

4.2 Classification

Classification of hot and cold rolled Bj LS based on its applicatin is shown in Table 1

Table 1 Use of Symbols

Description	Symbol	Application	Hardness (HRB)	Hardness (HV)**)
Cold rolled Bj LS	Bj LS-D-xxx-k	Commercial hard	Min. 85	Min. 170
	Bj LS-D-xxx-L2	Commercial ½ hard	74-89	135- 185
	Bj LS-D-xxx-L4	Commercial ¼ hard	65-80	115- 150
	Bj LS-D-xxx-L8	Commercial 1/8 hard	50-71	95-130
	Bj LS-D-xxx-L	Commercial soft	Max. 65	Max.115
	Bj LS-D-xxx-D1	Drawing quality	*)	*)
	Bj LS-D-xxx-D2	Deep drawing quality	*)	*)
	Bj LS-D-xxx-D3	Deep drawing <i>non aging</i> quality	*)	*)
	Bj LS-D-xxx-xxx	Construction		
Hot rolled Bj LS	Bj LS-P-xxx-C	Commercial		
	Bj LS-P-xxx-xxx	Construction		
Note: *) mechanical properties referred to base metal Bj D **) conversion results				

4.3 Chemical composition of base metal

Chemical composition of base metal conform to SNI 07-0601-2006 *Baja lembaran, pelat dan gulungan canai panas (Bj P)* and SNI 07-3567-2006 *Baja lembaran dan gulungan canai dingin (Bj D)*.

5 Quality requirements

5.1 Base metal

5.1.1 Nominal thickness and thickness tolerance of base metal of hot rolled sheets, plates and coils (Bj P) and cold rolled (Bj D) shall be as given in Table 2 and Table 3.

Table 2 Nominal thickness and thickness tolerance of base metal for hot rolled sheets, plates and coils (Bj P)

units millimeters

Nominal thickness	Width (L) L ≤ 1250
1,80	± 0,16
2,00	± 0,19
2,50	± 0,22
3,20	± 0,24
4,00	± 0,45

Table 3 Nominal thickness and thickness tolerance of base metal for cold rolled sheets and coils (Bj D)

Units millimeters

Nominal thickness Base metal (T)	Tolerance
0,20	± 0,010
0,25	±0,013
0,30	±0,015
0,35	±0,018
0,40	±0,020
0,45	±0,023
0,50	±0,025
0,60	±0,030
0,70	±0,035
0,75	±0,040
0,80	±0,040
0,90	±0,045
1,00	±0,050
1,10	±0,055
1,20	±0,060
1,40	±0,070
1,60	±0,080
1,80	±0,090
2,00	±0,100
2,30	±0,115
2,50	±0,125
2,80	±0,140
3,00	±0,150

NOTE Slit coil/sheet/strip in rolling direction. Thickness tolerance is 7,5% of total nominal.

5.2 Appearance

Holes, tears or bare spots (zinc-less spots) or any other defects that can impair its performance in use shall not be present on the surfaces of Bj LS.

5.3 Mass, size and tolerances

Mass, size and tolerance of flat and corrugated Bj LS shall conform to the requirements stated in Table 4 up to and including Table 16.

5.3.1 Mass of Bj LS coat

Mass, size and tolerance of Bj LS (both surfaces) for each coating designation shall comply with the minimum average value of the weight of samples taken from 3 different positions (3rd column in Table 4) and the lowest mass value of three weighing results shall not be less than the minimum coating given in column 4 of Table 4.

Table 4 Minimum mass of zinc coating on hot and cold rolled Bj LS

Coating type	Coating mass symbol	Minimum coating mass average of tests results (g/m ²) at 3 positions	Minimum coating mass (g/m ²)- at 1 position
Without alloying	Z60	600	510
	Z45	450	383
	Z35	350	298
	Z27	275	234
	Z25	250	213
	Z22	220	187
	Z20	200	170
	Z18	180	153
	Z14	140	119
	Z12	120	102
Alloyed	Z10	100	85
	F18	180	153
	F12	120	102
	F10	100	85
	F08	80	68
	F06	60	51
	F04	40	34

5.3.2 Mass of zinc coating applied to the steel sheets with specific thickness are shown in Table 5.

Table 5 Nominal thickness of base metal and symbol of minimum zinc coating

Nominal thickness of base metal	Symbol of zinc coating mass
0,20 - 0,25	Z10 ^{*)} , Z12
0,30 - 0,35	Z14
0,40 - 0,50	Z18
0,60 - 0,100	Z20
>1,00	Z22
NOTE ^{*)} Z10 for indoor use only	

5.3.3 Width and length of Bj LS flat sheets/coils

Width, length and tolerance of flat sheets/coiled Bj LS are shown in Table 6 up to and including Table 14.

Table 6 Nominal width of cold rolled zinc coated steel coils/sheets

Units in millimeters				
655 990 1170	762 1000 1219	882 1027 1250	914 1060	940 1100
NOTE width < 655 mm coil / slits are not specified in the nominal width table				

Table 7 Width and tolerances of cold rolled zinc coated steel coils/sheets

Width	Tolerances
$L \leq 1250$	+ 7 0
$L > 1250$	+ 10 0

Tolerances of Bj LS slits in longitudinal direction parallel with rolling direction of the steel coils are shown in Table 8.

Table 8 Width and tolerances of cold rolled zinc coated steel coils/sheets

Nominal thickness (mm)	Width (L)			
	$L \leq 160$	$160 < L \leq 250$	$250 < L \leq 400$	$400 < L \leq 650$
$0,20 \leq T < 0,60$	$\pm 0,15$	$\pm 0,20$	$\pm 0,25$	$\pm 0,30$
$0,60 \leq T < 1,00$	$\pm 0,20$	$\pm 0,25$	$\pm 0,25$	$\pm 0,30$
$1,00 \leq T < 1,60$	$\pm 0,20$	$\pm 0,30$	$\pm 0,30$	$\pm 0,40$
$1,60 \leq T < 2,50$	$\pm 0,25$	$\pm 0,35$	$\pm 0,45$	$\pm 0,50$
$2,50 \leq T \leq 3,60$	$\pm 0,30$	$\pm 0,40$	$\pm 0,45$	$\pm 0,50$

Table 9 Width and tolerance of hot rolled zinc coated steel coils/sheets

Units in millimeters

Type	Rolled product	Side cut rolled product
Thickness Width	$1,8 \leq T \leq 4,0$	$1,8 \leq T \leq 4,0$
$600 \leq L < 630$	+ 20 0	+ 10 0
$630 \leq L < 1000$	+ 25 0	+ 10 0
$1000 \leq L \leq 1250$	+ 30 0	+ 10 0

Table 10 Width and tolerance of zinc coated hot rolled slit steel coils

Units in millimeters

Thickness Width	$1,8 \leq T \leq 4,0$
$300 \leq L < 400$	+ 0,5
$400 \leq L < 630$	+ 0,5
$630 \leq L < 990$	+ 0,5

Table 11 Length and tolerances of zinc coated cold rolled steel coils/sheets

Units in millimeters

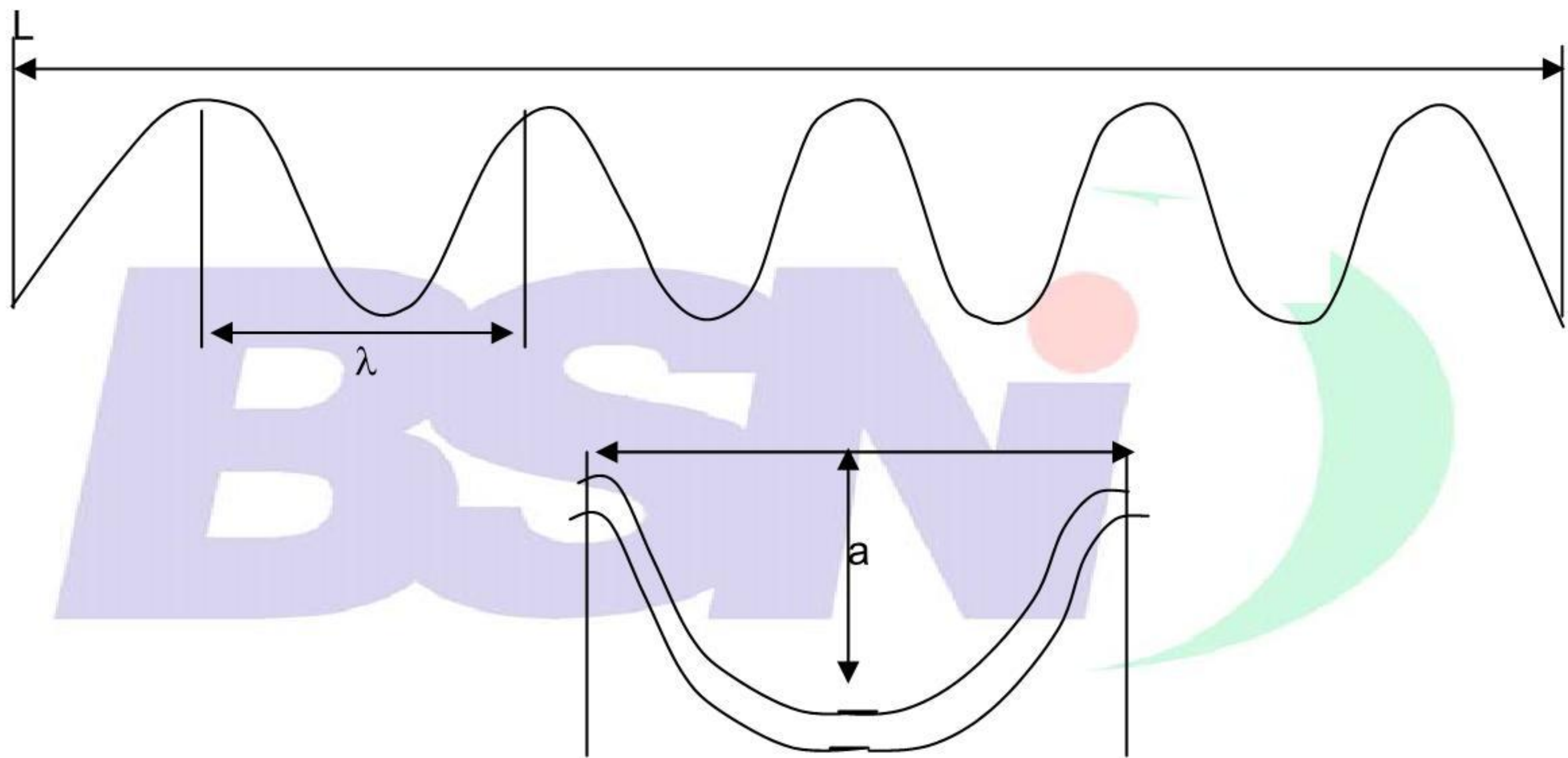
Length (P)	Tolerances
$P < 2000$	0, +10 0
$2000 \leq P < 4000$	0, +15 0
$4000 \leq P < 6000$	0, +20 0

Table 12 Length and tolerances of zinc coated steel coils/sheets

Thickness (mm)	
Length (mm)	$T \leq 4,00$
< 6300	$0, + 25 \text{ mm}$ 0
≥ 6300	$0, + 0,5 \%$ 0

5.3.4 Shape, size and tolerances of corrugated Bj LS

Shape, size and tolerance of Bj LS are shown in Figure 1, Table 13 and Table 14.



Notes:
L : width of sheet;
a : height of concave section
λ : length of wave.

Figure 1 Wave shape

Table 13 Sizes of corrugated zinc coated steel sheets

Designation of corrugated Bj LS		Width of steel sheet before corrugation (mm)			
		762	914	1000	1219
Large corrugated	L	665	800	875	1078
	λ	76,2	76,2	76,2	76,2
	a	18	18	18	18
Small corrugated	L	634	762	834	1028
	λ	31,8	31,8	31,8	31,8
	a	9	9	9	9

Table 14 Symbol and tolerances of corrugated zinc coated steel sheets

Units in millimeters		
Size	Symbol	Tolerances
Length of product	P	0, +15 0
Width of product	L	- 15, +25
Length of corrugation	λ	± 2
Height of corrugation	a	$\pm 1,5$

5.4 Calculation method of Bj LS mass and its tolerances

5.4.1 Determination of Bj LS mass and its tolerance is based on calculations and expressed in kg mass.

5.4.2 The calculation method of Bj LS mass is given in Table 15 according to the nominal size and mass of zinc coating.

Table 15 Bj LS mass calculation method

Calculation sequence		Calculation method	Notes
Base metal mass (kg/mm.m ²)		7,85 (thickness 1 mm x area 1 m ²)	
Specific steel mass (kg/m ²)		Base mass (kg/mm.m ²) x nominal thickness(mm)	Rounding to 4 significant numbers
Unit mass after coating (kg/m ²)		Base metal unit mass (kg/m ²) + coat mass constant (see Tabel 16)	Rounding to 4 significant numbers
Sheet	Sheet surface area (m ²)	Width (mm) x length (mm) x 10 ⁻⁶	Rounding to 4 significant numbers
	Mass of 1 sheet (kg)	Unit mass after coating (kg/m ²) x surface area (m ²)	Rounding to 3 significant numbers
	Total mass (kg)	Mass of 1 sheet (kg) x number of sheets	Rounding to kg
Coil	Unit mass of coil (kg/m)	Unit mass after coating (kg/m ²) x width (mm) x 10 ⁻³	Rounding to 3 significant numbers
	Mass of 1 sheet (kg)	Unit mass of coil (kg/m) x length (m)	Rounding to kg
	Total mass	Total mass of each coil	Rounding to kg

Table 16 Zinc coating mass conversion constant for determination of mass

Coating mass symbol	Conversion constant for coating mass (kg/mm ²)
Z 60	0,722
Z 45	0,565
Z 35	0,458
Z 27	0,381
Z 25	0,350
Z 22	0,305
Z 20	0,285
Z 18	0,244
Z 14	0,194
Z 12	0,183
Z 10	0,150

5.4.3 Mass per unit surface area of cold and hot rolled Bj LS (kg/m²) are shown in Table 17



Table 17 Theoretical value of Bj LS (kg/cm²) mass per unit surface area

Description of coat mass	(Z 10)	(Z 12)	(Z 14)	(Z 18)	(Z 20)	(Z 22)	(Z 25)	(Z 27)	(Z 35)	(Z 45)	(Z 60)
Mass constant	0,150	0,183	0,214	0,244	0,285	0,305	0,350	0,381	0,458	0,565	0,722
Nominal thickness											
0,20	1,720	1,753	1,748	1,814	1,855	1,875	1,920	1,951	2,028	2,135	2,292
0,25	2,113	2,146	2,177	2,207	2,248	2,288	2,313	2,344	2,421	2,528	2,685
0,30			2,569	2,599	2,640	2,660	2,705	2,736	2,813	2,920	3,077
0,35			2,962	2,992	3,033	3,053	3,098	3,129	3,206	3,313	3,470
0,40				3,384	3,425	3,445	3,490	3,521	3,591	3,705	3,862
0,45				3,777	3,818	3,838	3,883	3,914	3,991	4,098	4,255
0,50				4,169	4,210	4,230	4,275	4,306	4,383	4,490	4,647
0,60					4,995	5,015	5,060	5,091	5,168	5,275	5,432
0,70					5,780	5,800	5,845	5,876	5,953	6,060	6,217
0,75					6,172	6,192	6,238	6,269	6,346	6,453	6,610
0,80					6,565	6,585	6,630	6,661	6,738	6,845	7,002
0,90					7,350	7,370	7,415	7,446	7,523	7,630	7,787
1,00					8,135	8,155	8,200	8,231	8,308	8,415	8,572
1,10						8,940	8,985	9,016	9,093	9,200	9,357
1,20						9,725	9,770	9,801	9,878	9,985	10,142
1,40						11,285	11,340	11,371	11,448	11,555	11,712
1,60						12,865	12,910	12,941	13,018	13,125	13,282
1,80						14,435	14,480	14,511	14,588	14,695	14,852
2,00						16,005	16,050	16,081	16,158	16,265	16,422
2,30						18,360	18,405	18,436	18,513	18,620	18,777
2,50						19,930	19,975	20,006	19,083	20,190	20,340
2,80						22,285	22,330	22,361	22,438	22,545	22,702
3,00						23,855	23,900	23,931	23,008	24,115	24,272
3,15						25,033	25,078	25,109	25,186	25,293	25,450
4,00						31,075	31,750	31,781	31,858	31,965	32,12

5.4.4 Sheet mass tolerances

Sheet mass tolerance are stated in percentage of the calculated mass difference as specified in Clause 5.4.2 divided by calculated mass and shall comply with the requirements stated in Table 18.

$$\text{Sheet mass tolerance} = \frac{\text{Calculated mass} - \text{real mass}}{\text{Calculated mass}} \times 100 \%$$

Table 18 Sheet mass tolerance

Calculated mass of one lot	Tolerance (%)	Description
Mass < 600 kg	+ 8	Using same material, shape, size and same zinc coating mass
600 kg ≤ mass < 2 ton	+ 6	
Mass ≥ 2 ton	+ 4	

5.5 Mechanical properties of Bj LS

5.5.1 Tensile strength shall comply to the requirements of Table 19 dan Table 20.

**Table 19 Yield strength, tensile strength and elongation
(for Bj P base metal)**

Symbol	Yield strength N/mm ² (min)	Tensile strength N/mm ² (min)	Elongation % (min)	Tensile specimen
Bj LSPC	-	-	-	No. 5 in rolling direction
Bj LSP 340	245	340	20	
Bj LSP 400	295	400	18	
Bj LSP 440	335	440		
Bj LSP 490	365	490	16	
Bj LSP 540	400	540	16	

**Table 20 Yield strength, tensile strength , elongation and nonaging properties
(for Bj D base metal)**

Symbol	Yield strength N/mm ² (min)	Tensile strength N/mm ² (min)	Minimum elongation (%)						
			Nominal thickness (mm)						
			0,20 ≤ t < 0,40 (min)	0,40 ≤ t < 0,60 (min)	0,60 ≤ t < 1,0 (min)	1,0 ≤ t < 1,6 (min)	1,6 ≤ t < 2,5 (min)	≥ 2,5 (min)	Tensile specimen
Bj LSDL	-	-	-	-	-	-	-	-	No. 5, in rolling direction
Bj LSDK	-	-	-	-	-	-	-	-	
Bj LSDL2	-	-	-	-	-	-	-	-	
Bj LSDL4	-	-	-	-	-	-	-	-	
Bj LSDL8	-	-	-	-	-	-	-	-	
Bj LSDD1	-	270	-	36	36	37	38	-	
Bj LSDD2	-	270	-	38	38	39	40	-	
Bj LSDD3	-	270	-	38	40	41	42	-	
Bj LSD340	245	340	20	20	20	20	20	20	
Bj LSD400	295	400	18	18	18	18	18	18	
Bj LSD440	335	440	18	18	18	18	18	18	
Bj LSD490	365	490	16	16	16	16	16	16	
Bj LSD570	560	570	-	-	-	-	-	-	

5.5.2 Bend test

Bend test specifications for zinc coated sheets, corrugated sheets and coils are as follows:

- Angle of bend 180°
- Diameter of mandrel 4 x test piece thickness
- For medium class base metal with thickness exceeding 1,6 mm, the diameter mandrel shall be 2 x sample thickness

After the test, no stripping of the coating or cracking at base metal surface shall occur within 7 mm distance from the bend.

6. Sampling methods

6.1 Sampling shall be carried out by authorized personnel in accordance with existing regulations.

6.2 Samples to be tested shall be bundled to enable verification and each lot shall belong to the same class, size and composition designation and produced by essentially the same process during the same time interval.

6.2.1 1 (one) test sample of 1 (one) meter length shall represent up to 50 ton steel coils, and a sampling frequency of 1 (one) test for each additional 50 (fifty) tons shall be taken up to a maximum of 10 samples.

6.2.2 1 (one) sheet test sample shall represent up to and including 3000 sheets of the same specification, and a sampling frequency of 1 (one) test sheet for each additional 3000 sheets shall be taken up to a maximum of 10 samples.

6.3 The sample shall be drawn at random

6.4 The person in charge of sampling shall be given full access by the manufacturer or supplier.

7 Test methods

7.1 Mechanical properties test methods

7.1.1 Bend test

Bend test, using bend test sample of size 75 x 125 mm shall be in accordance to SNI 07-0410-1989, *Cara uji lengkung tekan logam*

7.1.2 Tensile test

Tensile test shall be in accordance to SNI 07-0408-1989, *Cara uji tarik logam* using tensile test sample complying to SNI 07-0371-1989, *Batang uji tarik untuk bahan logam*

7.2 Appearance

Bj LS appearance is inspected visually without the aid of any ancillary apparatus.

7.3 Coating test

Coating test is determined in accordance with SNI 07-0311-1989, *Cara uji lapis seng*

7.4 Bj LS base metal tests

7.4.1 Hardness test

Base metal hardness shall be determined after the zinc coating is removed and comply with SNI 07-0311-1989 and the hardness testing shall be in accordance with SNI 19-0406-1989, *Cara uji keras Rockwell B* or SNI 19-0721-1989, *Cara uji Keras Rockwell T* or SNI 05-0719-1989 *Cara uji keras mikro Vickers beban 0,0096 sampai dengan 49 N*

7.4.2 Thickness measurement

7.4.2.1 The thickness of the metal base of Bj LS shall be determined after the zinc coat is removed and in accordance with requirements of SNI 07-0311-1989 at not less than three test spots.

7.4.2.2 The thickness of the metal base shall be determined at the mid-width position of the sheet in the rolling direction. Thicknesses of strips, shall be determined in the rolling direction at a distance of minimum 25 mm from the side/edge.

7.5 Corrugated sheets

- height of corrugation shall be determined from the average of three waves height measurements,
- length of wave shall be determined from the average of five wave length measurements,

- unless specified, both edges of the corrugation waves shall be in the same direction up to one meter length

7.6 Thickness, width, length and mass measurement

For every Bj LS designation the thickness shall be determined using a micrometer, width and length using a measuring tape and the mass shall be determined with a weighing balance.

8 Acceptance requirements

8.1 A product batch shall be accepted after compliance with all requirements of clause 5.

8.2 If non compliance with any part of the requirements occurs, a retest shall be carried out using twice the number of samples of the initial test of the same batch.

8.2.1 If retest results shows compliance with all the requirements, the batch is accepted.

8.2.2 If any retest result does not comply with the requirements, the batch is rejected.

9 Marking

9.1 Bj LS sheets

Each sheet shall be marked using:

- The manufacturers name and trademark
- Bj LS-P or Bj LS-D specifications. Example: Bj LS-P 315-340, Bj LS-D 120-340, Bj LS-D060-L
- Nominal width x length dimensions in mm
- Symbol of zinc coating mass

The marking shall be legibly and durably marked including the manufacturers name and registered trade mark.

Special notes for Z10, not to be used for roofing.

9.2 Bj LS coils

Each coil shall be marked at the initial and end side of the coil with:

- The manufacturers name and trademark
 - Bj LS-P or Bj LS-D specifications Example: Bj LS-P 315-340, Bj LS-D 120-340, Bj LS-D060-L
 - Nominal length x width x thickness of base metal dimensions in mm
 - Symbol of zinc coating mass
- The marking shall be legibly and durably marked including the manufacturers name and registered trade mark.

Bibliography

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SNI 07-0410-1989, *Batang uji lengkung untuk bahan logam*

JIS G 3302, *Hot dip zinc-coated steel sheets and coils*

JIS G 3316:1987, *Shape and dimensions of corrugated steel sheet*

JIS G 1253, *Iron and steel – Method for spark discharge atomic emission spectrometric analysis.*













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